

CLAIMS:

1. An apparatus for levitating and transporting an object, wherein the apparatus levitates the object above the surfaces of a plurality of vibrators by air pressure of sound waves that are generated by the vibrators, the apparatus comprising:
- a plurality of vibration devices, each of which corresponds to one of the vibrators, wherein each vibration device includes a first transducer for vibrating the corresponding vibrator, each transducer including a super-magnetostrictive material; and
  - a common power source, which is connected to at least two of the first transducers for actuating the first transducers.
2. The apparatus according to claim 1, wherein each vibration device includes an adjuster for adjusting the impedance of the vibration device.
3. The apparatus according to claim 2, wherein the adjuster includes:
- a piezoelectric element, which converts mechanical energy into electric energy; and
  - an external impedance element, the impedance of which is variable.
4. The apparatus according to claim 1, wherein each first transducer produces standing waves in the corresponding vibrator.
5. The apparatus according to claim 1, wherein each vibrator is formed as an elongated plate, wherein the vibrators are parallel, and wherein each first transducer produces traveling waves in the corresponding vibrator for moving an object in

the longitudinal direction of the vibrators.

6. The apparatus according to claim 4, wherein each first transducer is coupled to one end of the corresponding vibrator, wherein the vibration device further includes second transducers, each of which is coupled to the other end of one of the vibrators, and wherein the second transducers are coupled to energy converting means for attenuating the vibration of the second transducers.

7. The apparatus according to claim 1, wherein the common power source is connected to all the first transducers.

8. An apparatus for levitating and transporting an object, wherein the apparatus levitates an object above the surfaces of a plurality of vibrators by air pressure of sound waves that are generated by the vibrators, the apparatus comprising:  
a plurality of vibration devices, each of which corresponds to one of the vibrators, wherein each vibration device includes a first transducer for vibrating the corresponding vibrator, each first transducer including a piezoelectric element, wherein each vibration device includes an adjuster for adjusting the impedance of the vibration device; and

a common power source, which is connected to at least two of the first transducers for actuating the first transducers.

9. The apparatus according to claim 8, wherein the adjuster includes:

a piezoelectric element, which converts mechanical energy into electric energy; and

an external impedance element, the impedance of which is variable.

10. The apparatus according to claim 8, wherein each first transducer produces standing waves in the corresponding vibrator.

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11. The apparatus according to claim 8, wherein each vibrator is formed as an elongated plate, wherein the vibrators are parallel, and wherein each first transducer produces traveling waves in the corresponding vibrator for moving an object in  
10 the longitudinal direction of the vibrators.

12. The apparatus according to claim 11, wherein each first transducer is coupled to one end of the corresponding vibrator, wherein the vibration device further includes second  
15 transducers, each of which is coupled to the other end of one of the vibrators, and wherein the second transducers are coupled to energy converting means for attenuating the vibration of the second transducers.

20 13. The apparatus according to claim 8, wherein the common power source is connected to all the first transducers.

14. An apparatus for levitating and transporting an object, wherein the apparatus levitates an object above the surface of  
25 an elongated vibrator by air pressure of sound waves that are generated by the vibrator, and wherein the vibrator produces traveling waves, the apparatus comprising:

a first transducer coupled to one end of the vibrator,  
the first transducer including:

30 a piezoelectric element, which converts mechanical energy into electric energy; and

a transducer for vibrating the vibrator;

a second transducer coupled to the other end of the

vibrator, the second transducer including a changing element, which changes output voltage or output current for converting mechanical energy into electric energy;

an external impedance element connected to the  
5 piezoelectric element, wherein the impedance of the external impedance element is variable;

an oscillator, which is connected to the first transducer for vibrating the first transducer;

a detector for detecting the vibration state of the  
10 second transducer; and

a controller, which controls at least one of the oscillator and the external impedance element based on the vibration state of the second transducer detected by the detector such that the output voltage or the output current of  
15 the changing element is greater than a predetermined value.

15. The apparatus according to claim 14, further including a vibration device, which includes the vibrator, the first transducer, and the second transducer, wherein the external  
20 impedance element is located in the second transducer for adjusting the impedance of the vibration device.

16. The apparatus according to claim 14, further comprising a load circuit, which converts mechanical energy into electric  
25 energy, and wherein the first and second transducers are selectively connected to the load circuit and the oscillator.

17. The apparatus according to claim 16, further including a switching device for switching the connecting state of the  
30 load circuit, the oscillator and the first and second transducers, wherein the switching device selectively changes the direction of traveling waves that are produced by the vibrator.